CS 3873
Computer Networks
Midterm 2 Solutions

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<th>Question</th>
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<td>Question 1</td>
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NAME:________________________________________

Instructions
1. Do all of the problems
2. You have 50 minutes for the exam
3. Show all your work
4. Do not separate midterm papers
1. (15 pts, 2.5 pts each) Answer the following True/False Questions. Explain your answer briefly.

(a) DHCP is used to get MAC address of a node whose IP address is known.

   False, ARP is used to get MAC address of a node whose IP address is known.

(b) MAC addresses change when nodes join a new network with different network address.

   False, MAC addresses are burned into ROM by manufacturer.

(c) A switch never learns a broadcast address.

   True, since broadcast address never appears as source of a frame, it can not be learned.

(d) BGP is a protocol for Intra-Autonomous System Routing

   False, BGP is an Inter-autonomous system routing protocol.

(e) FDMA is the ideal MAC Protocol.

   False, when only one node has data to send it is not possible for the node to get R throughput where R is total throughput of the link

(f) Hubs use self-learning algorithms to build hub table.

   False, Hubs just send the incoming bit to all outgoing interfaces.
2. (15 pts, 5 pts each) Explain the following concepts briefly.

(a) Assume that there is a separate machine for DHCP server and explain what happens when DHCP server crashes. Does the whole network fail or can the nodes still communicate?

*New nodes that need an IP address won’t be able to get an IP address to use the subnet. Nodes that already have an IP address can use it until their IP address lease expires.*

(b) Which of the following protocols are used when you connect your laptop to a new network and open a webpage with your browser? SMTP, UDP, DNS, ARP, HTTP, TCP, FTP, DHCP?

*DHCP, ARP, DNS, HTTP, TCP*

(c) How can MAC broadcast addresses such as FF-FF-FF-FF-FF-FF used in Ethernet help designing protocols? Explain by giving an example protocol that uses broadcast address.

*When a node does not know the MAC address of the destination, it needs to send a broadcast packet so that every node receives it. Such situations arise in ARP (broadcast ARP query packet), DHCP (DHCP server discover message) and many other protocols. It helps protocol design since you can reach the desired node without knowing its address and identity.*
3. (15+5 pts) Consider the following network. With the indicated costs, use Dijkstra’s shortest-path algorithm to compute the shortest path from t to all network nodes.

Solution

Fill in the following table to show execution of the algorithm

<table>
<thead>
<tr>
<th>Step</th>
<th>N'</th>
<th>D(s),p(s)</th>
<th>D(u),p(u)</th>
<th>D(v),p(v)</th>
<th>D(w),p(w)</th>
<th>D(x),p(x)</th>
<th>D(y),p(y)</th>
<th>D(z),p(z)</th>
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<td>∞</td>
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<td>4,t</td>
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<tr>
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Based on above information show the shortest path from t to all other nodes on the following graph using arrows. Shortest path from t to u is shown below as a hint.

Solution:
4. (25 pts, 7+6+6+6 pts) Consider the figure shown below. 9 Computers labeled A-F are connected using 2 switches. Computers A, B and C are on segment 1 and computers D, E and F are on segment 2.

![Diagram of a LAN with computers A-F connected by two switches.

Figure 1: LAN

Answer the following based on above figure.

(a) How many collision domains are there in the figure? List the computers on each collision domain. Two collision domains. First collision domain has computers A, B and C. Second collision domain has computers D, E and F.

(b) If one of the switches fails and stops responding. Can the computers on the network still send packets to each other successfully? Since the segments are connected by two switches, nodes can still communicate if one of the switches fails.

(c) Assume initially that switch tables are empty. Explain what happens when computer A sends a packet to broadcast address?

Both switches receive it update their switch table with A and both switches forward it to segment 2. Both switches receive each others transmission, update their switch table and forward it to segment 1. This continues as a loop.

(d) Assume initially that switch tables are empty. Show how the switch tables at switch A and Switch B are updated when computer A sends a packet to computer F?

Both switches receive it update their switch table with (A, interface 1) and both switches forward it to segment 2. Both switches receive each others transmission, update their switch table with (A, interface 2) and forward it to segment 1. This continues as a loop.
5. (25 pts) Consider the following figure. A new subnet with 60 hosts has been added to the network. Which subnet address should this new subnet use to provide enough usable addresses while wasting the fewest addresses.

129.115.1.0/27 has 32 usable address and last 8 bits start with 000
129.115.1.32/28 has 16 usable addresses and last 8 bits start with 00010
129.115.1.48/28 has 16 usable addresses and last 8 bits start with 0011

New subnet should support 64 addresses, so first two of the last 8 bits will be fixed. Since 00 is used we can use 01. So, subnet address will be 129.115.1.64/26